

## **ABSTRACT OF THE DISCLOSURE**

Embodiments of the invention generally provide an electron beam substrate processing system. In one embodiment, the present invention provides an electron beam substrate processing system where a spindle shaft used to rotate substrates during processing includes at least one optical encoder wheel assembly. The optical encoder wheel assembly is configured to provide rotational speed data signal to a rotational speed control system and a pattern generation clock circuit configured to provide an angular pattern generator clock signal and to a pattern generator circuit. The pattern generation circuit is configured to control modulation of an electron beam used for substrate processing. In one aspect of the present invention, while the spindle shaft is rotated at a constant linear velocity, the pattern generation circuit controls the modulation of an electron beam such that written mark lengths are sized to be about constant in angular dimension.